

BRYOPHYTES OF CHETCO RIVER REDWOOD STATE
PARK, OREGON

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The Redwood State Park along the Chetco River, about eight miles inland from Brookings in Curry County, Oregon, is one of three known stations of the coast redwood (*Sequoia sempervirens*) north of the California border. A second isolated grove is reported several miles farther inland along the Chetco River and the third station is presumably just north of the boundary between the two states. Although many botanists have visited these areas, the moss flora there, to my knowledge, has not previously been investigated.

The Chetco River road is unsurfaced and lumber trucking raises clouds of dust which blanket the vegetation. Most discouraging is the havoc created by ruthless lumbering in the canyon. At the time of my visit, September 3 to 9, 1950, the immediate area of the redwoods on the north bank of the river appeared undisturbed although Douglas trees (*Pseudotsuga taxifolia*) in the neighborhood had been cut. Although no recently cut redwoods were seen on the ridge across the river, that area has been cleared of other marketable trees. It is a tragedy that ecologists may now never investigate this most interesting vegetational area in its original state.

During the summer and autumn before the rains begin, the winding Chetco River consists of a series of deep pools alternating with shallow stretches over gravel bars where the river can easily be forded. The pools are flanked by steep rock bluffs on their deep side and by wide gravel deposits on the other. The clean gravel beds and the gently moving river provide desirable camp sites which happily have not been commercialized.

The bryophytes which were observed in this area are listed under their respective families. I am indebted to Mrs. E. C. Sutcliffe for identifying the few liverworts included. The nomenclature and arrangement of the mosses is according to Koch (1950). The collection numbers (in parentheses) are mine. A set of the specimens will be deposited in the Herbarium of the University of Michigan and duplicate specimens, where available, will be placed in the Herbarium of the University of California.

MARCHANTIACEAE

MARCHANTIA POLYMORPHA L. Juvenile.

METZGERIACEAE

METZGERIA CONJUGATA Lindb. (3233).

JUNGERMANNIACEAE

BLEPHAROSTOMA TRICHOPHYLLA (L.) Dum. (3283d).

LEPIDOZIA REPTANS (L.) Dum. (3257).
SCAPANIA BOLANDERI Aust. (322c).

SELIGERiaceae

BLINDIA FLEXIPES (Ren. & Card.) Kindb. (3269). The bent setae and the larger plants of this and other Pacific Coast specimens appear to separate them from the circumboreal species, *Blindia acuta* (H.) Br. & Sch., under which name they were formerly reported (Koch, 1950). *Blindia flexipes* belongs to the Pacific Coast Element (Koch, 1951) ranging from Alaska south to California and inland to Idaho (*Setchell*, UC; *Howell*, CAS; *Leiberg*, UC). I have not seen specimens of *B. acuta* from south of British Columbia although it probably does grow in the mountains of Washington.

DICRANACEAE

DICHODONTIUM PELLUCIDUM (H.) Sch. (3271).
DICRANUM FUSCESCENS Smith (3242).

FISSIDENTACEAE

FISSIDENS GRANDIFRONS Brid. (3263).
F. LIMBATUS Sull. (3244, 3260, 3273).
F. PAUPERCULUS Howe. (3265, 3284a).
F. RUFULUS B. S. G. (3275).

POTTIACEAE

TIMMIELLA CRASSINERVIS (Hampe) L. F. Koch (3288).
WEISSIA CONTROVERSA H. (3235).

GRIMMIACEAE

GRIMMIA ALPICOLA H. var. RIVULARIS (Brid.) Broth. (3262, 3297).
RHACOMITRIUM VARIUM (Mitt.) Lesq. & James (3292).
SCOULERIA AQUATICA Hook. (3245, 3270).

BRYACEAE

EPIPTERYGIUM TOZERI (Grev.) Lindb. (3261, 3284).
ORTHODONTIUM GRACILE B. S. G. (3256).

MNIACEAE

LEUCOLEPIS MENZIESII (Hook.) Steere (3287).
MNIUM GLABRESCENS Kindb. (3222).
M. INSIGNE Mitt. (3230).

AULACOMNIACEAE

AULACOMNIUM ANDROGYNUM (H.) Schwaegr. (3258).

BARTRAMIACEAE

ANACOLIA MENZIESII (Turn.) Paris (3283a).
BARTRAMIA POMIFORMIS H. (3285).

ORTHOTRICHACEAE

AMPHIDIUM CALIFORNICUM (C. Muell.) Broth. (3283).
ORTHOTRICHUM CONSIMILE Mitt. (3295).
O. LYELLII Hook. & Tayl. (3294).
ZYGODON VIRIDISSIMUS (Dicks.) R. Brown (3291).

CRYPHAEACEAE

DENDROALSIA ABIETINA (Hook.) E. G. Britt. (3278).

LEUCODONTACEAE

ANTITRICHIA CURTIPENDULA (H.) Brid. (3231, 3239).
BESTIA OCCIDENTALIS (Sull. & Lesq.) Grout (3228a).
PTEROGONIUM GRACILE (H.) Smith (3228d).

NECKERACEAE

NECKERA DOUGLASII Hook. (3282).
NECKERADELPHUS MENZIESII (Drumm.) Steere (3238).
POROTHAMNIUM BIGELOVII (Sull.) Broth. (3225).

THUIDIACEAE

- CLAPODIUM BOLANDERI Best (3283b).
 C. CRISPIFOLIUM (Hook.) Ren. & Card. (3232, 3277, 3280).
 C. WHIPPLEANUM (Sull.) Ren. & Card. (3274).
 HETEROCLADIUM HETEROPTEROIDES Best (3247, 3248).

BRACHYTHECIACEAE

- EURHYNCHIUM OREGANUM (Sull.) Jaeg. & Sauerb. (3286).
 E. STOKESII (Smith) Sch. (3293).
 PSEUDISOTHECIUM STOLONIFERUM (Brid.) Grout (3237).
 SCLERPODIUM COLPOPHYLLUM (Sull.) Grout (3253, 3279).
 S. OBTUSIFOLIUM (Drumm.) Mac. & Kindb. Common.

PLAGIOTHECIACEAE

- ISOPTERYGIUM ELEGANS (Brid.) Lindb. (3234, 3250).
 PLAGIOTHECIUM DENTICULATUM (H.) Sch. (3259).
 P. UNDULATUM (H.) Sch. (3296).

HYPNACEAE

- HYPNUM CIRCINALE Hook. (3241).
 H. SUBIMPONENS Lesq. (3228).

RHYTIDIACEAE

- RHYTIDIADELPHUS LOREUS (H.) Warnst. (3227).
 R. TRIQUETRUS (H.) Warnst. (3226).

POLYTRICHACEAE

- ATRICHUM UNDULATUM (Hedw.) Pal.-Beauv. (3243).

The following information about the bryophytes in this outpost of the coast redwood forest may give some idea of the interesting ecological aspects of this area.

Marchantia polymorpha, represented by scattered, immature rosettes, was the only bryophyte observed on the occasional sandbars along the river. Stable boulders or rock masses, obviously submerged at high water, supported extensive mats of *Scleropodium obtusifolium* in which many clumps of *Scouleria aquatica*, *Grimmia alpicola* var. *rivularis*, and *Rhacomitrium varium* were interspersed. At the base of a steep rock bluff, one rock mass was bedecked with numerous cushions of *Blindia flexipes*.

Fissidens rufulus grew in abundance on boulders barely emergent from the water of a tributary stream, but only a single clump of *Fissidens grandifrons* was found on a submerged rock in the water from a spring. Emergent rocks alongside were covered with *Eurhynchium Stokesii*. Wet sand between rocks in seeps along the river banks supported tufts of *Dichodontium pellucidum*.

Fissidens limbatus and *Epipterygium Tozeri* were the most common inhabitants of otherwise barren, recently disturbed soil in shaded sites. *Atrichum undulatum*, *Scleropodium colpophyllum*, *Weissia controversa*, and *Timmiella crassinervis* were less abundant and apparently require more specific and permanent substrata. Comparatively stabilized banks in forested areas well above the disturbing influence of high water were usually covered with *Claopodium Whippleanum*, often intermingled with *Fissidens limbatus*. Occasionally delicate mats of *Isopterygium elegans* were seen

on soil adjacent to protruding rock masses or the bases of large trees. *Hypnum subimponens* flourished on a thick deposit of silt over a rotten log with *Bestia occidentalis*, *Eurhynchium oreganum*, *Pseudisothecium stoloniferum*, *Pterogonium gracile*, *Leucolepis Menziesii*, and *Metzgeria conjugata* as associates. A large cluster of *Rhytidiadelphus loreus* and one of *Rhytidiadelphus triquetrus*, each over a foot in diameter, grew with the western sword fern (*Polystichum munitum*) along the sandy base of a shaded bank along the flood plain under California laurel (*Umbellularia californica*) and tan oak (*Lithocarpus densiflorus*). On a nearby bank was a large colony of *Mnium insigne*.

Most large rock masses, ten to twenty feet above the water line were largely covered with mats of *Pseudisothecium stoloniferum*. Where considerable soil accumulated over the tops of some of these boulders, *Leucolepis Menziesii* grew vigorously. *Pseudisothecium stoloniferum* is the predominant moss on branches of most trees in the area along the river but *Leucolepis* was found elsewhere only at the base of a large laurel with *Claopodium crispifolium* and in thick mats of other mosses like *Eurhynchium oreganum*. *Porothamnium Bigelovii* was common in all shaded habitats but was particularly proliferous on a huge shaded laurel trunk and formed extensive mats on the lower surfaces of large rock masses in deep shade.

Scattered clusters of *Zygodon viridissimus* and *Orthotrichum Lyellii* were collected from the trunk of large Douglas trees on which some *Hypnum circinale* was usually present. *Orthotrichum consimile* was taken from the limbs of a large rhododendron. One large rock mass in dense shade had an extensive growth of *Heterocladium heteropteroides* in crevices on its protected side.

The most luxuriant mixture of mosses in this vicinity was over large decaying logs in deep shade. *Mnium glabrescens* grew vigorously with *Eurhynchium oreganum*, *Plagiothecium undulatum*, *Pseudisothecium stoloniferum*, and *Scapania Bolanderi* on logs. The only large mat of *Plagiothecium undulatum* seen in this area was on a large well-rotted log, probably a redwood, on the wooded flood plain across the river from the redwood grove. Other logs which still retained their bark were covered with *Claopodium crispifolium* in pure stands or in mixture with *Neckera Douglasii*, *Bestia occidentalis*, *Porothamnium Bigelovii*, *Pterogonium gracile*, and *Pseudisothecium stoloniferum*. One large, relatively intact Douglas tree log supported a luxuriant growth of *Hypnum circinale* and scattered clumps of *Dicranum fuscescens*. On the flood plain only one small patch of *Antitrichia curtispendula* was seen on a fallen branch.

Upstream from the park, on a steep north facing bank

of the river, the main limbs of large laurel trees were festooned with *Neckera Douglasii*, whereas tan oak trunks were bedecked with *Dendroalsia abietina*, and a nearby maple trunk was draped with a curtain of *Neckeradelphus Menziesii*. In shaded crevices of the adjacent rock bluff overhanging the stream, *Bartramia pomiformis* and *Amphidium californicum* occurred with *Anacolia Menziesii*, *Claopodium Bolanderi*, *Timmiella crassinervis*, and *Blepharostoma trichophylla*. A thick mat of *Antitrichia curtipendula* was found on a recently felled Douglas tree log.

The discovery of *Fissidens pauperculus* and *Orthodontium gracile* in this northernmost station of the coast redwood is of particular interest. *Fissidens pauperculus* was first found here on bare sand packed with gravel under the overhanging forest duff in deep shade in company with *Fissidens limbatus* and later with *Epipterygium Tozeri* on wet sand at the bottom of a hole left by an uprooted maple tree on the flood plain across the stream. *Fissidens pauperculus* was not abundant at either station and apparently occupies a solid but temporary substratum which is submerged at high water. On more permanent soils it presumably cannot compete with more vigorous species like *Fissidens limbatus* and *Epipterygium Tozeri*, which are found in most mesophytic sites in California. *Orthodontium gracile* was detected on the charred base of a single decayed redwood stump associated with *Aulacomnium androgynum*, *Plagiothecium denticulatum*, and *Lepidozia reptans*.

Fissidens pauperculus was previously known only in Marin and Santa Cruz counties in California (Koch, 1948, 1949) but has since been found in the redwoods of Napa and Monterey counties as well as in intermediate localities. *Orthodontium gracile* had been recorded from Santa Cruz, San Mateo, Sonoma, Mendocino, and Humboldt counties (Andrews, 1932; Koch, 1949) and has also been discovered recently in Monterey County. It is also known from isolated stations in Great Britain and France (Margadant & Meijer, 1950) where its peculiar range has received a great deal of attention.

The association of certain mosses with the coast redwood is believed to represent evidence for a more general concurrence in the distribution of mosses and conifers than exists between either of these groups and flowering plants (Koch, 1951) although direct evidence needs to be accumulated.

Bartramia pomiformis is the only moss reported here which is not also known to occur in California (Koch, 1950); presumably careful investigation of the northernmost counties in California will uncover that species.

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REVIEWS

Plant Embryology. By DONALD ALEXANDER JOHANSEN. The Chronica Botanica Company, Waltham, Massachusetts. xviii + 305 pp., frontispiece, figures 1-80. 1950. \$6.00, regular memoir edition; \$14.00, special edition.

Because of the time-consuming nature of the work, American botanists for the most part have been unwilling to undertake monographic treatises in particular fields as was formerly done by many of the Europeans, especially the Germans. In the field of embryology the only work of such a nature has been the exhaustive survey, "Embryologie der Angiospermen" by the Austrian, Schnarf, which was published from 1927-29. Like the older workers and like many today, such as Maheshwari, Schnarf considered embryology in its broad meaning to include studies on mega- and microsporogenesis, mega- and microgametogenesis, and development of the structures of the ovule before and after fertilization, as well as study of the embryo. Since the publication of his work many additions to the literature on embryology have appeared. Therefore, Dr. Johansen's monumental work is especially welcome at this time, even though he has limited himself to what he considers embryology proper.

To Dr. Johansen plant embryology embraces embryonic morphology, embryonic physiology, and embryogeny. In the present work the treatment of embryological topics is restricted to the latter field with its divisions of embryogenesis, embryotectonics, embryogenergy, and embryonomy. He has attempted to make a correlation and evaluation of the